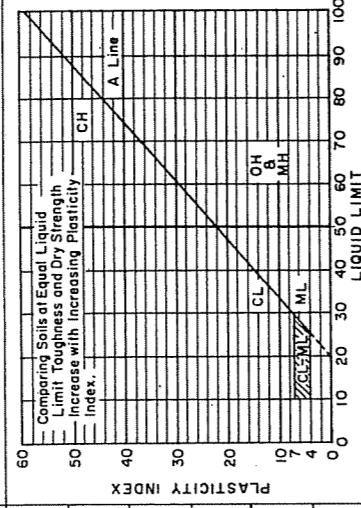


REVISION	DATE	DESCRIPTION	BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
<b>HURRICANE PROTECTION NEW BEDFORD - FAIRHAVEN PLAN AND RECORD OF UPSTREAM EXPLORATIONS</b>			
SUBMITTED BY <i>[Signature]</i> HEAD, RECORD SECTION		PROJECT ENGINEER	
APPROVAL RECOMMENDED <i>[Signature]</i> CHIEF, NEW BEDFORD BRANCH		APPROVED DATE FEB 1960	
CHIEF, PLANNING & REPT'S BRANCH		CHIEF, ENGINEERING DIVISION	
SCALE		SPEC. NO. DRAWING NUMBER	
SHEET 11 OF 11			

UNIFIED SOIL CLASSIFICATION (Including Identification and Description)				Laboratory Classification Criteria		
Major Divisions		Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weight).		
Coarse-grained Soils More than half of material is larger than No. 200 sieve size	Gravels More than half of coarse fraction is larger than No. 4 sieve size.	Gravels (Little or no fines)	Well graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for GW	
			Poorly graded gravels, or gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
Fine-grained Soils The No. 200 sieve size is about the smallest particle visible to the naked eye.	Sands More than half of coarse fraction is smaller than No. 4 sieve size. For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size.	Sands with Fines (Appreciable amount of fines)	Silty gravels, gravel-sand-silt mixture.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols. Alterberg limits above "A" line with PI greater than 7	
			Clayey gravels, gravel-sand-clay mixture.	Plastic fines (for identification procedures see CL below).		
Sands More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	Sands with Fines (Appreciable amount of fines)	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for SW	
			Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
Sands More than half of coarse fraction is smaller than No. 4 sieve size.	Sands with Fines (Appreciable amount of fines)	Sands with Fines (Appreciable amount of fines)	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).	Limits plotting in PI between 4 and 7 are borderline cases requiring use of dual symbols. Alterberg limits above "A" line with PI less than 4 Alterberg limits above "A" line with PI greater than 7	
			Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
			Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: GW, GP, SW, SP, GM, GC, SM, SC Less than 5% 5% to 12% More than 12%			
			Identification Procedures on Fraction Smaller than No. 40 Sieve Size Dry Strength (Crushing Characteristics)      Consistency (Reaction to Shaking)      Toughness (Consistency near PL)			
Fine-grained Soils The No. 200 sieve size is smaller than No. 200 sieve size	Silt and Clays Liquid limit is less than 50	Silt and Clays Liquid limit is greater than 50	Inorganic silts and very fine sands, rock flour, silty clayey fine sands, or clayey silts with slight plasticity.	None to slight	Quick to slow	None
			Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium
Highly Organic Soils	Silt and Clays Liquid limit is greater than 50	Silt and Clays Liquid limit is greater than 50	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight
			Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium
			High to very high	None	High	High
			Medium to high	None to very slow	None to very slow	Slight to medium
			Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.		



PLASTICITY CHART  
For laboratory classification of fine-grained soils

For laboratory classification of fine-grained soils with clay binder.

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder.  
 (2) All sieve sizes on this chart are U. S. standard.

NOTE

For further information on Unified Soil Classification, refer to "The Unified Soil Classification System", Volumes 1 and 2, Technical Memorandum No. 3-357, published by U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. File copies may be examined at Headquarters, U. S. Army Engineer Division, New England, 424 Tropic Road, Waltham, Massachusetts, Building 141, Foundation and Materials Branch.

Adopted by Corps of Engineers and Bureau of Reclamation, January 1952.